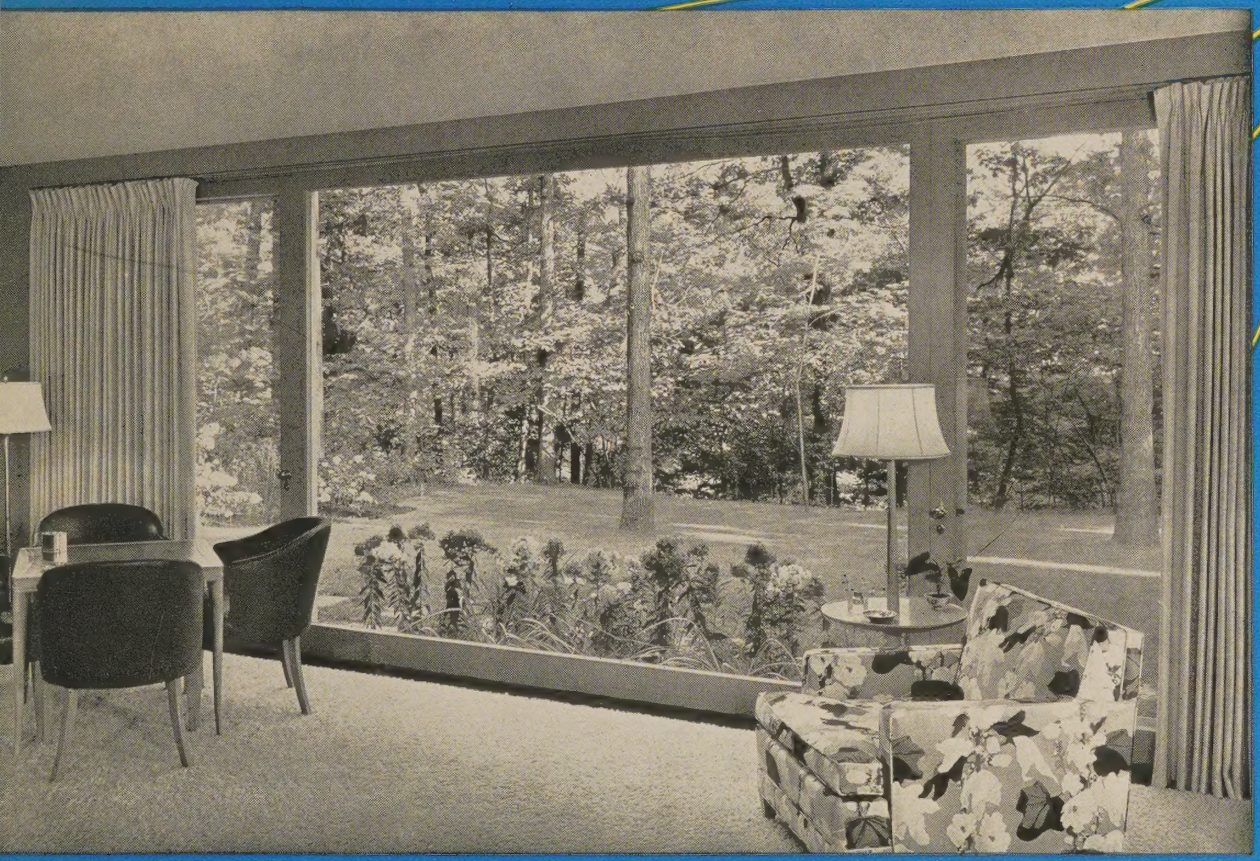
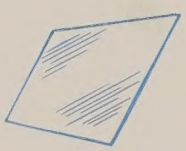
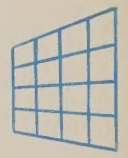
SOLAR HOUSES

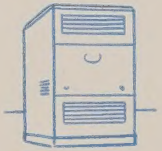
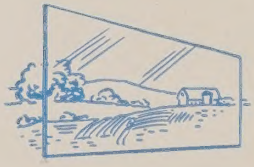
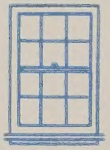


an architectural lift in living

A.I.A. FILE No. 26-A-5

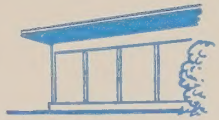
Open House

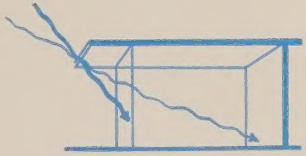
For years people dwelt in "blind" houses because heating was a problem and glass  came in small panes 

Today heating systems  are improved and glass comes in large sizes  The "ribbon window" and windows of conventional shape  enlarged and turned sideways provide better light inside and improved views.

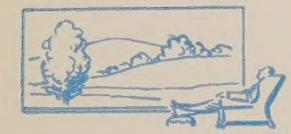
THE COVER PICTURE

Credit is acknowledged to Architect James F. Eppenstein of Chicago in reproducing on the cover of this booklet the interior of a home built to his design in Highland Park, Ill.

The sun can be controlled with roof over-hangs  to permit

the low-hanging winter sun to enter  when you want Solar heat

and keep it out in summer. This provides glareless light and enables you to live

 without that closed in feeling. Draperies

give you privacy when needed. Open-plan houses are beginning to polka dot the

entire map . People feel better when their

homes are bright and cheerful. So let's open up our houses to admit more daylight.

Open House

Why not plan for Better Living?

The building of a home represents, for the average man, his largest individual life-time investment. He can ill afford mistakes.

When a commercial or industrial building is planned, the per square foot cost is figured on the basis of what the structure will be able to produce and earn for its owners or occupants in dollars and cents.

The prospective home owner cannot figure on such tangible returns. His profit must be measured in terms of comfort, health, easier, more economical maintenance of his home surroundings, pride of ownership and the sense of security and well-being that goes with it—in a word, he must measure in terms of Better Living.

In order to be operated profitably, factories and office buildings must be planned with extreme care. So too, then, should the home be planned with great care. Too often it is not.

Too often husband and wife have based their new home

on ideas obtained while "driving around" some residential district, or picked one out from a page of some catalog plan book—in many cases pretty largely because the exterior looked "cute." Little attention was paid at the time to the interior layout from the standpoint of whether it fit their specific needs, or future requirements.

Some of us are swayed by emotional desirability rather than rational analysis; often ruled in our judgment by intuitive likes and dislikes.

Perhaps these days of swift change will serve to alter some of our methods of determining what we want for a home. On the other hand, the war may have led some of us to expect too much. Volumes have been written about the type of house which will be built in the future. Perhaps many of us are looking forward to push-button miracles which won't materialize.

As a matter of fact, houses designed for better living are here, and have been here for some time. The war interrupted housing trends that were developing rapidly, and new products and methods undoubtedly will accelerate those trends as the years go on.

However, it seems logical to expect that refinements of tried-and-true materials and methods, and a better understanding of the products we have been using right along, probably will play an equally important part in hastening the evolution in housing which has been under way for some time. Few authorities in the building industry expect miracle materials or methods to be developed overnight.

This book, therefore, does not attempt to anticipate any feats of magic. Its sole purpose is to outline a modern approach to house planning geared to today's rather than yesterday's standards of living. Specifically it deals with one form of the open-plan type of house known as Solar housing. Let's mentally lift off its roof and take a peek.

Just what is a Solar House?

Just what is a Solar house? Well, the answer is relatively simple. Fundamentally, it is a house designed to take advantage of Solar radiation as an auxiliary source of heat. By means of transparent glass walls on southern exposures, the radiant energy of the winter sun, when it swings low on southern horizons, is allowed to enter and warm homes. Overhanging roof constructions serve as visors to keep out the direct Solar rays during the summer months when entry of heat is not desired.

In the milder climates of our southern, southwestern and far western states, the trend to larger window areas, even to whole walls of glass, has been increasing as home owners sought to blend the outdoors with interiors for more enjoyable views and more abundant natural daylight within their houses.

With the development of an insulating windowpane, this trend to the open-plan type of dwelling became practical for all climates.

A Solar house can have most any kind of architectural design. Naturally, the principles of Solarization, with its many benefits which contribute to better living, can be achieved much more efficiently in the open-plan type of house, to a lesser degree in traditional types of architecture.

Solar housing has many advantages aside from sun utilization as a heating plus in cold climates, but before considering them, here are the three fundamental principles of such design: orientation, large windows and sun control.

Orientation

This means facing as many rooms to the south as possible to obtain the heating plus benefits of solar radiation in winter. Additionally, if the view possibilities are sufficiently inviting, plan window areas to the east, west or north to incorporate such scenes. If movable sash is used, orient floor plans and window areas with prevailing summer breezes if possible.

Large Windows

Large window areas are necessary to provide proper entry of solar radiant energy in winter months. Double-glass insulation should be used. From the standpoint of view possibilities, the surroundings should be studied with the idea of planning windows accordingly. Landscaping should be planned both for views and screening for privacy when conditions make it advisable.

Sun Control

This is achieved by the use of permanent or temporary roof over-hangs, visors or other means of controlling shadow areas on the windows so that sunlight can enter during cold weather and be shut out during warm weather. There are various elements involving sun control and it is suggested that Pages 12, 13, 14 and 15 be studied carefully. Architects should be consulted to assure proper engineering.

RULE NO. 1
Orientation

Face your house toward the Sun

Some dictionaries define the word "orientate" as meaning to move or turn toward the east. In the language of the architect, however, orientation means the laying out of a plan in relation to specific elements—sun position, wind direction, etc.

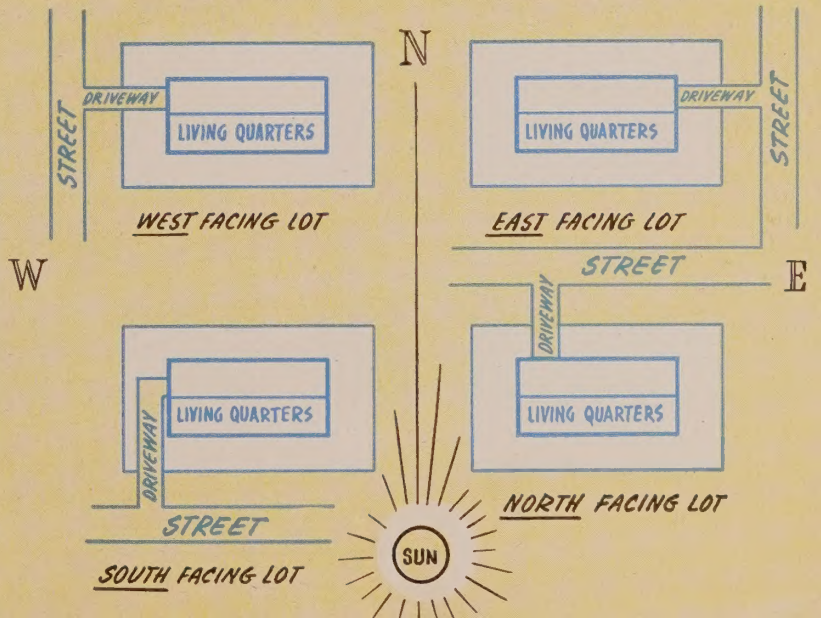
Thus, in Solar housing, orientation has come to mean the designing of a house so that the living quarters are faced toward the sun.

The degree of orientation of room areas varies, of course, in relation to the available footage facing south. For example, a lot with a 100-foot dimension running east and west permits more of the rooms to be faced south or to have southern exposures than a lot with a 50-foot east-west dimension.

A narrow east-west dimension obviously confines Solarization largely to the living room. However, skillful planning might include a bedroom, or, if preferable, the dining room and kitchen. Conditions vary, and individual desires differ, and thus influence the final plan. Additionally, the limitations of a narrow east-west dimension are lessened for those who prefer a two-story house.

It should be remembered that property need not face south in order to achieve a southern exposure for the living quarters. It has come to be recognized that even though it has been the general practice for many years to face a house toward the street, it is not at all necessary to do so. Often, many advantages, regardless of the Solar principle, are attained by "turning" the house away from the street so that the living quarters face the south.

This simplified sketch shows the fundamentals of orienting or planning living areas to face the sun. Such orientation can not be accomplished in every instance, there being literally thousands of different conditions existing because of lot sizes—front footage limitations, hilly land, etc. However, the four sketches suggest some of the possibilities of facing the main rooms—if only the living room—south regardless of which direction the lot faces. Try out this idea with your own lot in mind.



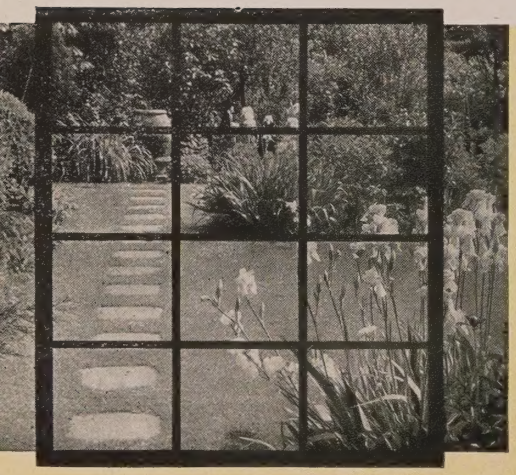
RULE NO. 2
Large Windows

Use large Glass areas to admit abundant light

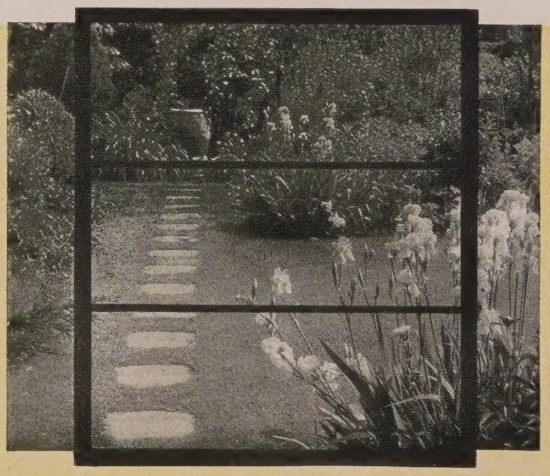
Rule No. 2 calls for large windows along the south or sun wall of Solar houses. These glass areas not only admit the sun in winter for heat utilization, but throughout the year such "opened up" walls provide an abundance of good natural light.

Eyes function better in well-lighted rooms. Moreover, eyes can relax when one is able to look at distant scenes instead of having vision confined by the limitations of the usual wall areas.

Large windows naturally call for larger individual panes of glass. Such large panes are economical to maintain. Note that the window at the left has 48 corners to clean. The middle one has only 12, and the one at the right only four. No wonder such windows can be cleaned so easily, and with far fewer finger nail casualties.



A familiar type of window. Note how the horizontal and vertical mullions, dividing the glass into many small panes, interfere with good vision and present an annoying barrier to full enjoyment of the garden.



A step toward better vision. This window-pane treatment is in keeping with modern trends. All vertical mullions have been removed. Incidentally, such a window offers more economies in repainting or cleaning.

Note how the same view improves when viewed through this large modern type of windowpane. Many beautiful bits of scenery —a lawn, garden or tree—changing with the seasons, become a year-round mural.

Photographs courtesy Phillip W. Koellisch, landscape consultant, 10323 Crestwood Avenue, Cleveland, Ohio.

RULE NO. 2 *Continued*

Thermopane...the windowpane that insulates

There is nothing complicated or mysterious about Thermopane. It is a new insulating windowpane, prefabricated to take advantage of the well known principle of the double-glass or storm sash method of insulation. The insulating layer of dehydrated air between the two panes of glass is sealed in by a patented metal-to-glass bond around the edges of the two panes.

This insulating windowpane is installed in single sash just like single panes, although allowance must be made in the sash to take care of the increased thickness of the unit. It provides efficient insulation, yet only two surfaces, like single glass, need be cleaned.

Thermopane, now available for building construction after 14 years of research and field test installations, makes the Solar principle—practiced by the Swiss 300 years ago and the Chinese for centuries before that—easy to incorporate in cold climates and enables the architect and engineer to utilize open-plan designing without excessive heat losses through windows.

HANDICAPS IN PAST

Architects and engineers are limited in design largely by the materials and products available to them. For example, early American architecture, such as is generally referred to as Colonial and Cape Cod, was characterized by small window areas and small window panes.

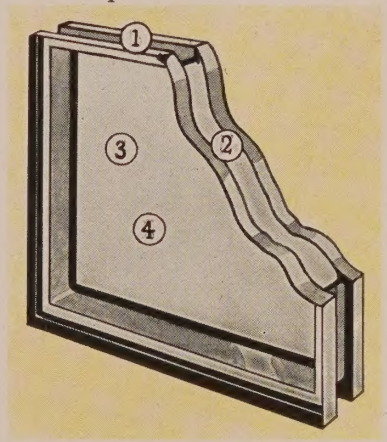
Such windows were largely the result of a lack of central heating systems and the fact that glass manufacturers could make only small panes of glass. Additionally, windows were taxed in Colonial days. Such conditions influenced architects to use fewer and smaller windows.

TREND TO LARGER WINDOWS

Today there is no tax on windows. There is no tax on daylight, no tax on the sun. The air is free, too . . . and so the trend to larger windows, to more abundant, more efficient light, and more attention to utilization of the sun's energies for heating, have been natural results of improved products, improved methods and a better understanding of how to utilize them.

To overlook the value of modern windows is to overlook the economic use, the healthful use, the free use of Man's greatest source of energy—the sun.

★ ★ ★



This cross sectional cutaway illustrates the construction features of Thermopane. It is a sandwich—two layers of glass sandwiching a sealed in dehydrated air space.

The patented metal-to-glass seal (1) bonds the two panes of glass into one unit. Such a bond is designed to keep out moisture and dirt. The insulating layer of air (2) is scientifically cleaned, dried and sealed in at the factory.

The dry air is sealed in with the patented bond to prevent condensation and frost from forming on the inner surfaces (3) of the glass, and, like a single pane of glass, only the two outside surfaces (4) require cleaning.

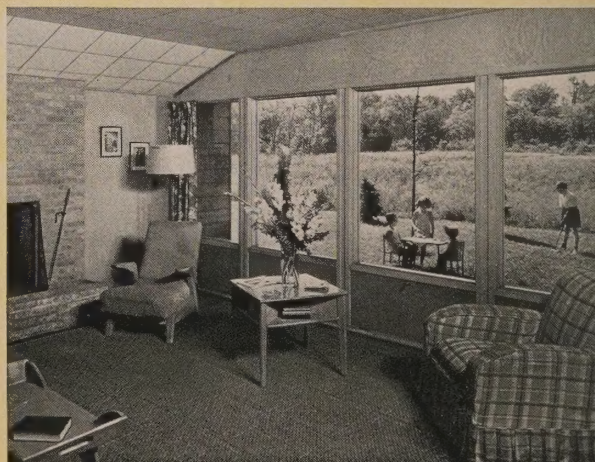
Double Thermopane units range in size from 8″x8″ up to panes 60″x100″, or approximately five feet by eight feet.

RULE NO. 2 *Continued*

Windows can do Wonders!

Picture Windows, characteristic of every Solar house, are an effective part of the plan for better living in this residence, designed by R. Franklin Outcalt, Cleveland.

". . . Out of windows we walk onto lawns in summer and meet men and women, and in winter windows are drums for the splendid music of storms that makes us feel so masterly 'round our fires. But for windows, we should have to go out-of-doors to see the daylight. After the sun, which they serve, I know of nothing so beneficent as windows. Fie upon the ungrateful man who has no window-god in his house, and thinks himself too great a philosopher to bow down to windows. May he live in a place without windows for awhile to teach him the value of windows. As for me, I will keep the high worship of windows till I come to a windowless grave." . . . *Hilaire Belloc.*



The window wall of a Solar house makes it easy for mother to glance out to see if the youngsters are all right. Architect: George Fred Keck.

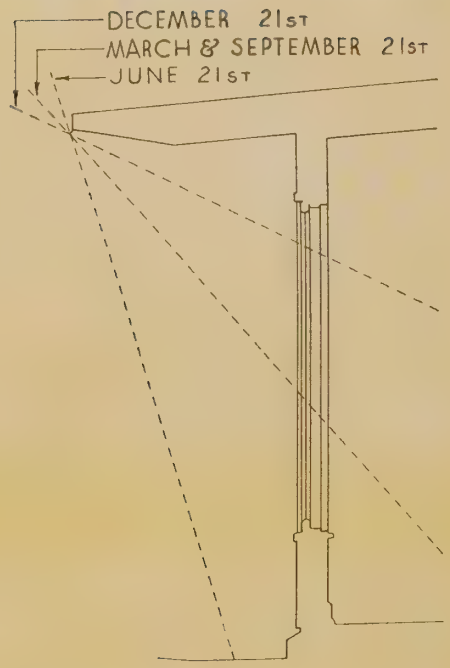
Note use of windows in this home designed for better living. Drapes provide privacy when desired. Architect: Richard J. Neutra, Los Angeles.

Pleasant views of the lawn and trees add greatly to the enjoyment of this Illinois home designed by Architects Pereira & Pereira of Chicago.

Better daytime lighting is one of the many advantages obtained by using large expanses of windows. Architect: William Deknatel, Chicago.

The outdoors becomes, in effect, a part of the living room when a window wall of glass is used. Architect: John Ekin Dinwiddie, San Francisco.

Give your house a hat brim



Following Rule No. 3 for Solar housing—control of the sun (1) to utilize its heat in winter, (2) to keep it out in summer and (3) to use its light the year 'round —is a matter of architectural design.

This concerns a roof over-hang or extension sufficient to prevent direct sun rays from entering south-facing rooms during the heat of the summer day. A hat has a brim to help keep the sun out of one's eyes, without excluding the light. Solar housing is much like that.

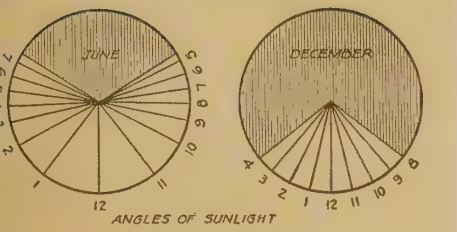
In some areas a four-foot roof extension is used. The width of the eave or over-hang (or sun visor) varies in different sections of the country. For example, a house in Minnesota would require a different extension than a house in Texas or South Carolina.

Roof extensions need not necessarily be permanent or an integral part of the house. They can be designed to be taken down in the fall, if local conditions make it practical. Some over-hangs consist of slats that permit air flow but are tilted to permit entry of light while serving as a screen against entry of direct sun rays. Some are designed as a trellis, so that wide-leaved plants growing over them in summer act as the sunshade or visor.

This view taken in a Solar house at 12 noon on Dec. 21 in Chicago, shows how the low-hanging winter sun penetrates the room.

The same room at 12 noon on June 21. Note that the sun does not enter. However, the large windows permit more daylight to enter.

FIGURE H



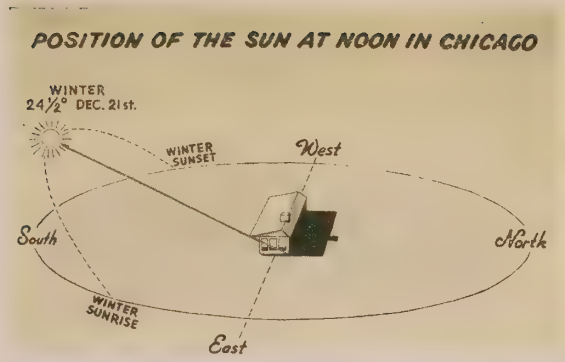
In planning roof extensions to prevent direct sun rays from entering south-facing rooms during summer months, the angles of sunlight should be studied.

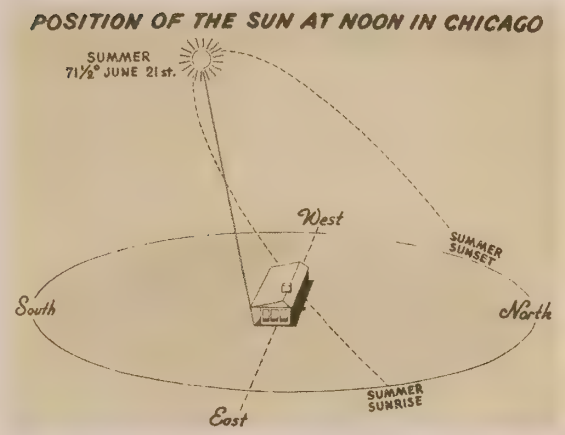
Permanent or fixed roof over-hangs should provide for openings to prevent accumulation of heat pockets, and in areas where high wind velocities are prevalent, provision should be made to meet the conditions.

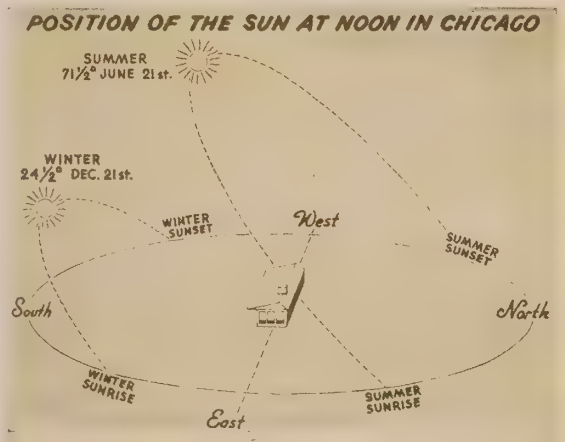
In determining the width of the brim or roof over-hang for a Solar dwelling, angles of sunlight and the varying altitude of the sun as to latitude and season must be determined. This can be done with relative accuracy by architects or engineers through study of the conditions which prevail in the localities in which they are working.

The seasonal tilting of the earth accounts for the high and low paths of the sun in summer and winter. The three charts shown at the right visualize how this works out in a typical area. It will be noted that the roof extension serves to control the entry of the direct rays of the sun.

Typical angles of sunlight are shown in Figure H at the left. Knowing the sun's angles for the winter and summer solstices, various types of over-hangs or shields can be designed to provide effective control of shadows on the face of the building, as shown in Figure J on page 15.







The sun shines oftener than you think

The sun shines oftener during the winter months than most people realize. A check of local government weather bureau records discloses a surprisingly high number of sunshine hours per day, for example, during the months of December, January and February.

In Chicago, the total of sunshine hours during those three months is 53.6 per cent in relation to the total possible hours of sunshine. This average percentage is based on a 39-year record.

Elsewhere on this page is a table of average sunshine hours in widely scattered areas of the United States. More complete data is available at any of the weather bureaus for those who wish to obtain such information.

It should be kept in mind, however, that solar heat is available in winter months even though the sun is not shining. Irving F. Hand, in charge of solar radiation investigations, United States Weather Bureau, Blue Hill Observatory, Milton, Mass., says: "Assuming the heat value (solar radiation) of a clear day to be 100 per cent, from 60 to 80 per cent as much should be received on hazy days, and from five to 50 per cent might be expected on dull days."

That's one way of explaining that efficient sun-ray heat is functioning, even though the sun is more or less obscured. Perhaps sun power on cloudy days can be better understood by referring to the common experience of countless numbers who have had the uncomfortable experience of severe sunburn on days when the sun was not shining. While the sun energy causing such sunburn represents a different type of ray (ultra violet) than that which is utilized for heating a Solar house (infrared rays), it does illustrate that the power is there even though we don't actually see it.

Percentage of Sunshine Hours In Key Cities

Below are listed the percentage of hours of sunshine in relation to the total of possible daylight hours from Sept. 15 to June 15 in representative communities of the United States, based on weather bureau averages of 33 key cities:

	Length of weather records	Percentage of sunshine hours
Atlanta	46 years	59.7
Boston	37 years	55
Chicago	39 years	53.6
Cincinnati	37 years	53
Columbus, Ohio	37 years	49.3
Dallas	30 years	59
Denver	40 years	66
Des Moines	37 years	57.3
Detroit	40 years	43.3
Galveston	53 years	60.4
Helena, Mont.	37 years	53
Houston	34 years	54
Indianapolis	34 years	52
Kansas City, Mo.	40 years	60.3
Little Rock	50 years	5[illegible]
Los Angeles	47 years	72
Memphis	42 years	56
Milwaukee	30 years	52.6
Minneapolis	16 years	51
Montgomery, Ala.	33 years	62
New Orleans	53 years	56
New York City	36 years	58
Oklahoma City	46 years	63
Philadelphia	50 years	57.3
Pittsburgh	34 years	46.6
Portland, Ore.	53 years	38.8
Salt Lake City	41 years	62
San Antonio	38 years	55
San Francisco	53 years	66
Seattle	48 years	39.3
Spokane	46 years	46.5
Tampa	47 years	65.44
Toledo	31 years	46.3

It is interesting to note that during the daylight hours of the winter season, the sun shines more than 50 per cent of the time in all except seven of the cities listed, based on weather bureau averages ranging from 16 to 53 years.

A quantitative analysis of solar heat input would naturally require long-term observations of total solar intensities by hour and sun angle for the heating season together with average outside temperatures for the same period. Since these data would vary with every geographical location it can readily be seen that it is impossible (in the absence of such information) accurately to report the solar heat input which can be utilized.

What does "Insolation" mean?

Insolation has a variety of meanings relative to the sun, but in the language of the architect and engineer employing Solar heat radiation, it concerns how Solar radiation is absorbed, trapped and utilized for heating an interior.

In using the double-glass principle of insulation against heat loss, the designer counts on Thermopane, the insulating window-pane, to play a dual role, (1) sharp reduction of loss of heat generated by the heating plant, and (2) absorption and trapping of the Solar radiation. This latter is called Insolation.

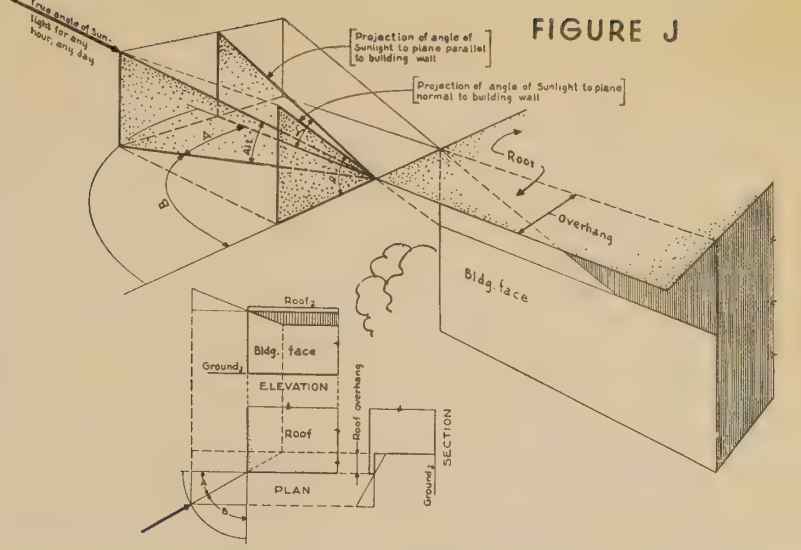
Let's review the situation briefly. The principle of solar heating, mentioned by Xenophon about 400 B.C., has been utilized in therapeutics, in horticulture, winter sports (Sun Valley), as well as in the heating of domestic hot water in recent years.

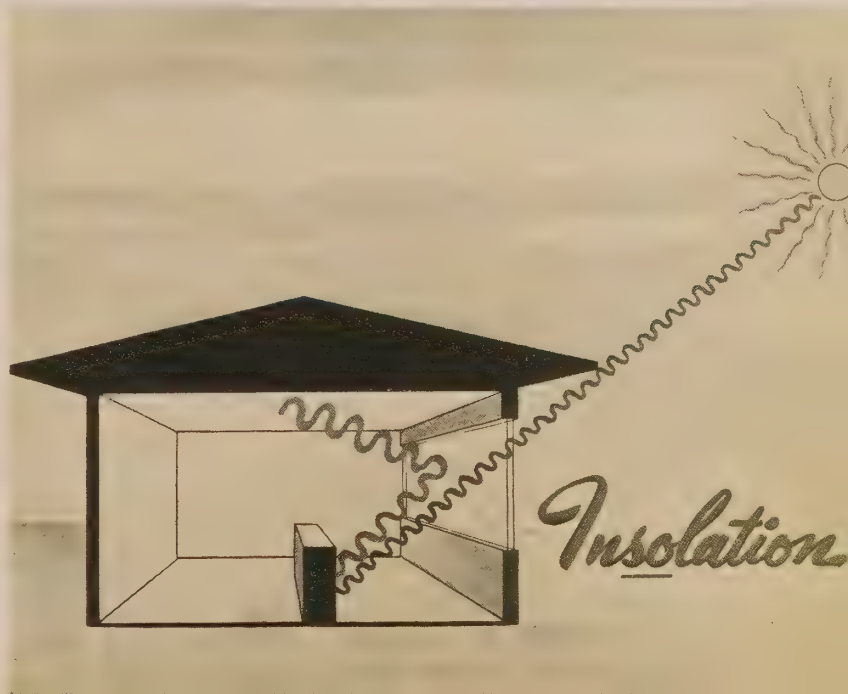
NOW HEAT LOSS CAN BE CUT

One difficulty, however, always presented itself in using the sun's heat in buildings. The solar heat gain through single window-panes was offset by heat losses due to rapid conduction through the single or uninsulated panes, particularly at night and during varying daytime conditions in frigid weather.

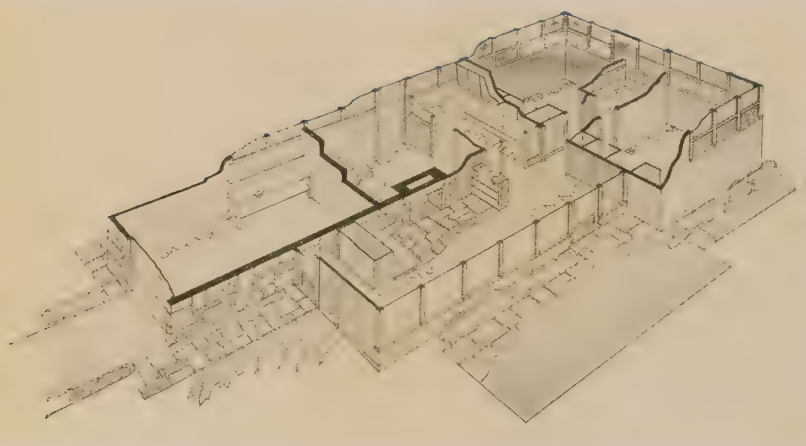
Thermopane slows down such heat losses, yet permits entry of solar heat as a plus. Such heat enters through the glass on a short wave length. This ray strikes and warms objects within the room. The re-radiated ray now is of a longer wave length and is not transmitted through the glass, and thus is absorbed, trapped and utilized.

FIGURE J





What does a Solar House look like? *Well, here are*

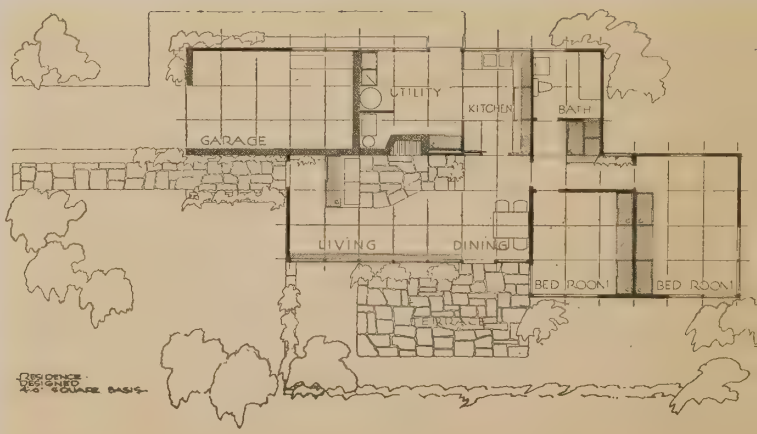


In looking at this bird's eye or isometric view, visualize the dwelling as laid out on a 50-foot lot facing west. Instead of facing the house in that direction, however, Architect John Richards of Bellman, Gillett & Richards, Toledo, oriented the living area to the south. Spacious window areas are allowed for the north and east, but they are placed high along the walls. At the lower right is an alternate floor plan.

What a Solar house looks like depends largely upon what the prospective home owner wants. He may want a flat roof or a hip roof; a one-floor or two story house. He may want five rooms or eight rooms or more.

Other factors influencing design include the east-west dimension of the property. Further, the appearance of the dwelling depends upon kinds of materials used (wood, brick, stone or a combination); topography of the land and how it is landscaped.

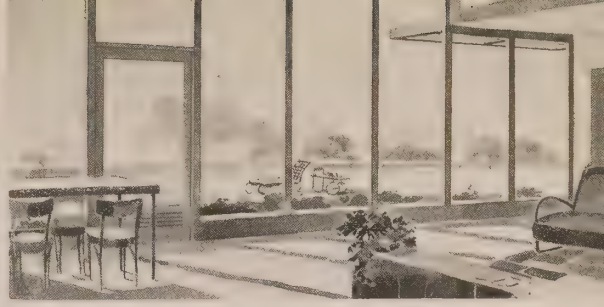
There are dozens of approaches, but on these pages are reproduced some fundamental design suggestions. With a mythical 50-foot lot having a natural west frontage to a street running north and south, three different roof treatments have been designed for one basic floor plan, oriented to the south. Each incorporates different window treatments. An alternate floor plan showing how both bedrooms could have a south exposure is included.

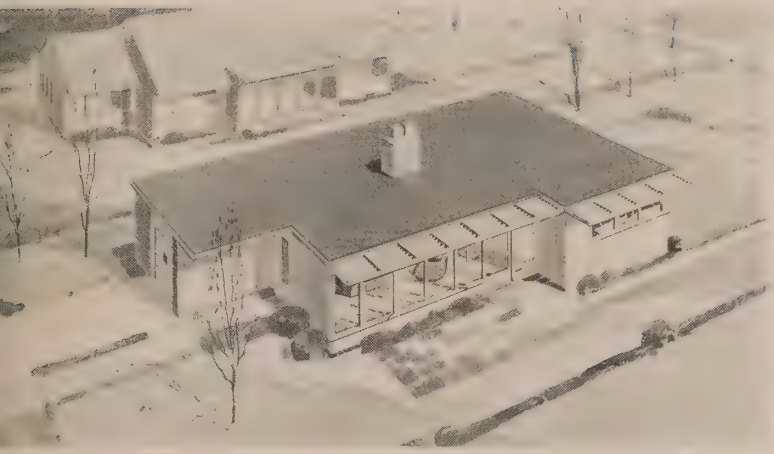


Here is the same basic floor plan, but the north bedroom has been moved forward to give it a south exposure, too. Simultaneously, it permits the addition of another bedroom (or den or playroom) at the north. Designed to be built well under $10,000, the utility and kitchen merge their "working" areas, although a sliding translucent glass partition could be used, or a solid partition provided, if desired.

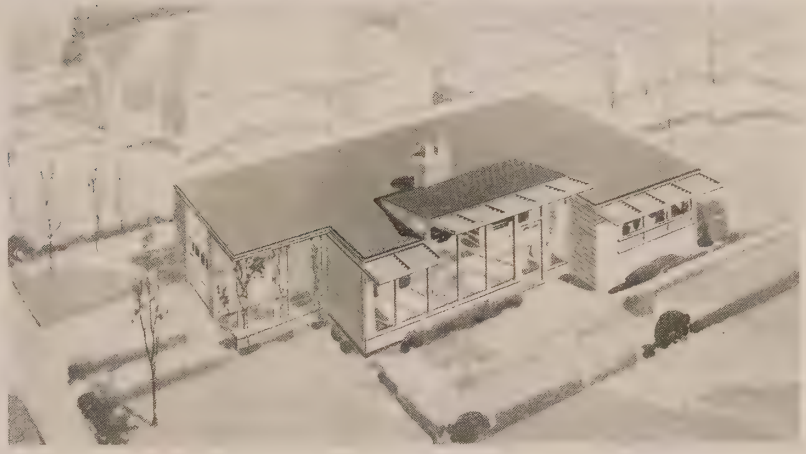
some examples . . .

Right—This sketch shows some of the open-plan possibilities of a Solar house with the living and dining areas oriented to the south. Designed to efficiently utilize the winter sun as a heating auxiliary, the window wall of Thermopane provides for excellent views and an abundance of natural light—rain or shine.





Here's how the floor plan, shown on the opposite page, might look with a flat roof. The over-hang is of the vented slat type. Note that the window treatment calls for a combination of fixed and movable sash. If conditions warrant, the use of a fence, or tall shrubbery, would screen off the view from the street and add to the over-all attractiveness of the property.



An interesting innovation for the flat-roof style at the left is provided by a roof upswing that "breaks" the straight line and provides additional light within the dwelling. The interior view, illustrated above, was drawn with this roof style in mind. All fixed sash, with ventilating louvres under the door and under the bedroom windows, are used in this interesting plan.

This sketch of a window detail shows the use of operating sash at top and bottom of fixed sash for ventilating purposes. Additional provision for light and protection against rain are features of such a window.

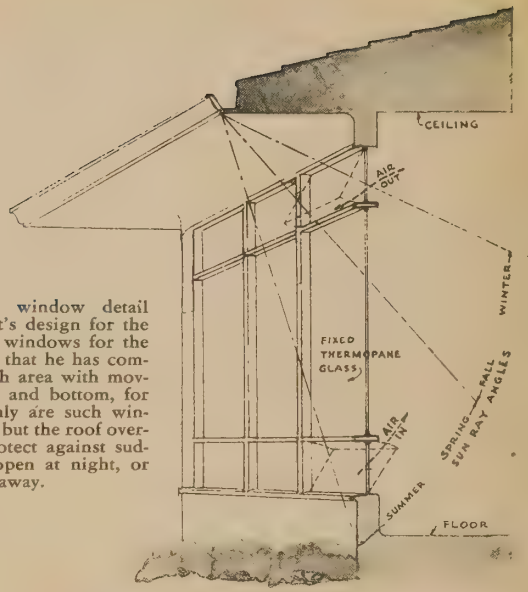
TYPICAL VENTILATING SASH

Here's a conception of a Solar house with the identical floor plan, but with the more conventional or hip roof design. A third window idea here has been suggested. Moving the door to the center, the architect has suggested a picture window (fixed sash) on each side and flanked them with two large windows having movable sash at top and bottom for ventilation. A detail of the operating sash is shown at the left on this page.

A variety of design suggestions

For those who do not want to break too sharply with traditional design, Architect T. Y. Hewlett, Toledo, has created an interesting Solar idea by using large window areas, featuring large-pane Thermopane. The hip roof is designed to extend as an over-hang. The center area could feature a Picture Window.

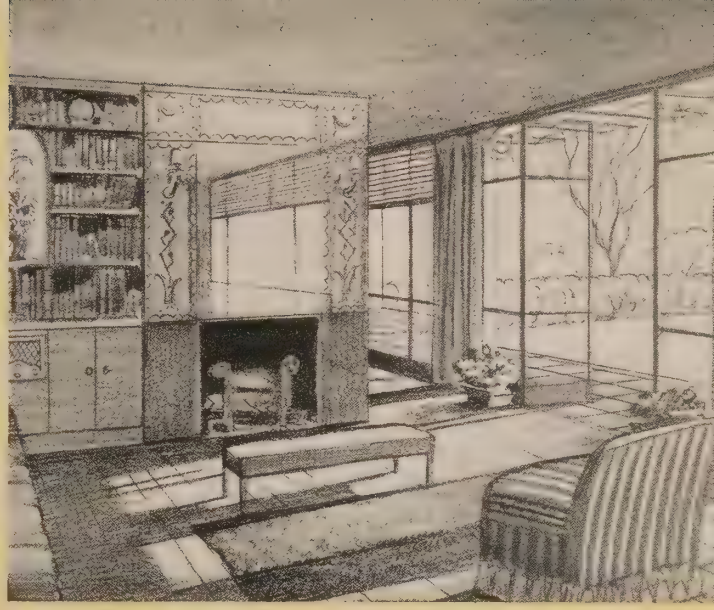
An interesting alternate in the straight-line roof for the above dwelling has been provided below by Architect Hewlett. By raising the roof section at the center he incorporated an attractive change entailing no special construction. Here again the center window wall could be designed as a Picture Window.

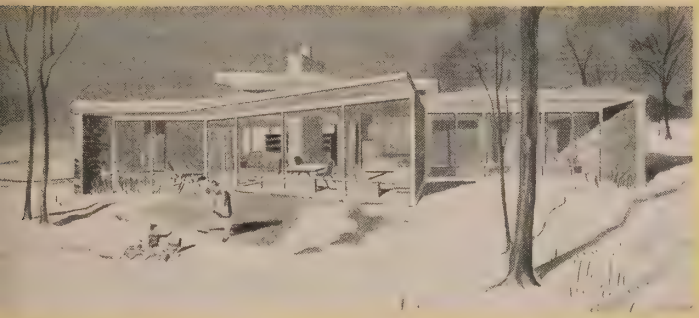


This cross-section window detail shows the architect's design for the large Thermopane windows for the house below. Note that he has combined the fixed sash area with movable windows, top and bottom, for ventilation. Not only are such windows easy to clean, but the roof overhang and vents protect against sudden rains, if left open at night, or while the family is away.

Below, Architect Hewlett, again using familiar architectural exterior lines, suggests a design that would be popular in practically any part of the United States. The south wall encloses a combination living and dining room, and, extreme right, two bedrooms, one of them set back from the front line.

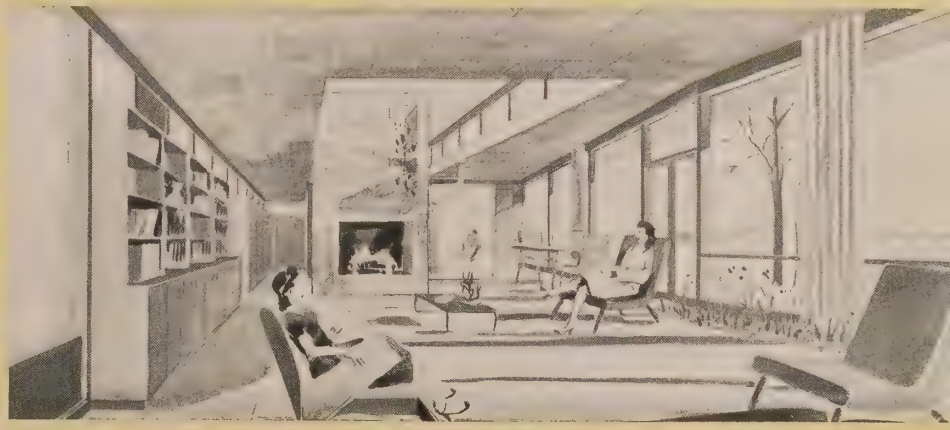
Left and right—Here is presented a "solarized traditional" as created by Architect Cameron Clark of New York City. Himself modern-minded, Mr. Clark has combined a bit of New England, flavored with New Orleans and "solarized" with window walls, as pictured at the right. Note that the second-floor windows are protected by a permanent roof visor, while the first-floor windows are shaded against summer sun by a trellis designed for large-leaf myrtle or similar plants.





Left, center, is an exterior view of the south or sun wall of a George Fred Keck Solar house. Mr. Keck, by utilizing clerestory windows, has modified the flat roof design and at the same time provided light and ventilation for the bath, situated in the center.

Below—This interior, by Architect Keck, Chicago, is a type of Solar house he believes will become increasingly popular and particularly suitable for midwest cold-belt states. The dining room is visible beyond the fireplace. Note use of clerestory windows.



Left—The north side shows the use of ribbon windows, placed high, providing light, but protection against north winds. This view shows the clerestory windows. They provide good light for the centrally located bath and additional light for both the kitchen and dining alcove.

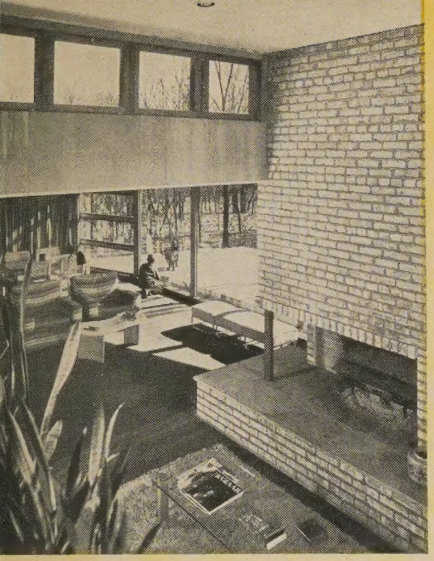
Designed for Better Living

Above—Roof visor and large windows feature this Highland Park, Ill., home. Note glass doors flanking each side of the Picture Window. Architect: James F. Eppenstein.

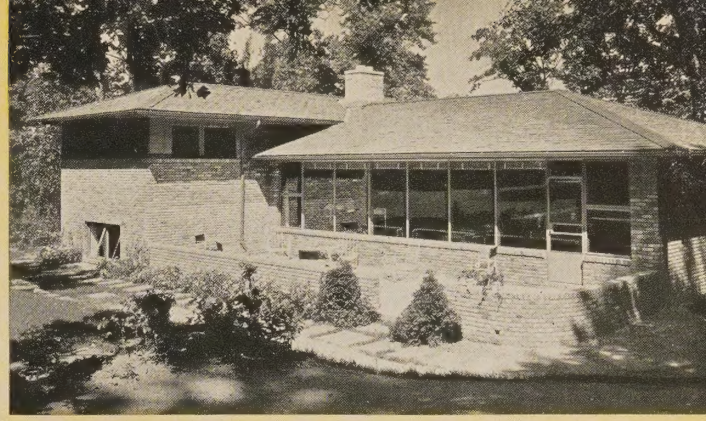
The open-plan house above is in Glenview, Ill. The spacious window walls of the south side of the dwelling are shaded by trees in summer. Architect: Arthur Purdy.

Dramatic, indeed, is the sweep of window walls of this Keck-designed Solar house in Cary, Ill. Magnificent views are available. Note the porthole vents in the roof extension. These vents serve to prevent hot air pockets.

Left and right—Because of its unusual window treatment, two views of a Solarized residence in Providence, R. I., are presented. The interior shows two of the large panes of glass across the sun wall. Winter sunlight filters in, unhampered by the trellis-slat overhang. On the second floor, the banks of windows are shadowed in summer by a permanent shield. All windows are of Thermopane. Architects: Samuel Glaser and L. L. Rado.



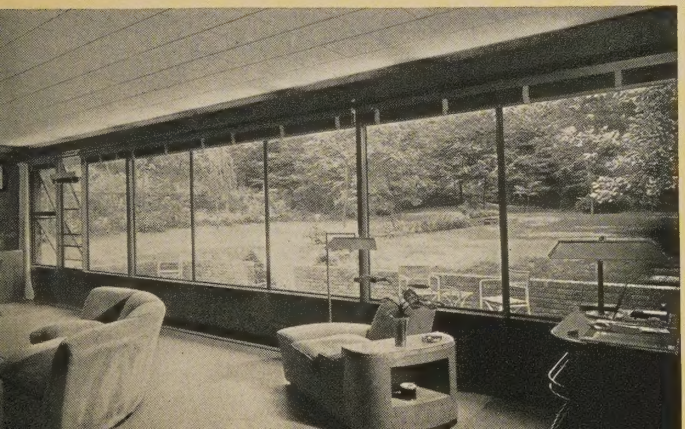
Left—Effective use of the clerestory window idea is made by Architect Purdy in this Glenview, Ill., residence. (An exterior of this house is reproduced on the opposite page, center.) The picture was taken from a stair landing, part of the house being of two-story construction. The clerestory windows provide east light for the foreground space shown in the photograph.



Right—One of the country's most interesting Solar-type houses in the cold-belt area is one designed by Architect H. W. Johanson in Roslyn, L. I. The spacious living room has a complete window wall of Thermopane. Because of its unusual above ground three-level design, two other views are shown, lower left and lower right.

Right—In Canada, where the climate often gets "hip deep," Thermopane serves effectively in large window areas. This view, for example, shows one of the Picture Windows in the residence of J. C. Reid near Windsor. This beautiful expanse of window is glazed, of course, with a double-glass Thermopane insulating unit.

The photographs reproduced on these pages illustrate some of the possibilities when homes are designed for truly better living. Modern in exterior and interior treatment, such residences are and have been providing for living geared to today's standards. They represent what a home can be like by thoughtful application of materials in a manner that does not align us with an age when living was more problem than pleasure. Such design is attainable today in the large residence or small cottage.



Left and Right—Two striking views show an unusual use of glass for open-plan design in the Roslyn, L. I., home pictured at the upper right. At the left is an excellent example of the ideal window wall-Thermopane. An abundance of glareless natural light floods the room, with good views possible from any angle. At the right, Architect Johanson has made clever use of a ribbon window and mirrors to achieve a feeling of cheerful spaciousness. What seems to be an almost unbroken expanse of windows is created by reflection in the dresser mirror, left, and the vanity mirror, right.

Questions and Answers

Thousands of letters about Solar housing have been received from every state in this country—city, village and farm; from soldiers, sailors and marines in Alaska, Africa, Australia and England; from architects, engineers, builders and bankers. Here are some representative questions, picked at random, and answers to them:

Are there any other advantages to Solar housing aside from using the sun as a heating element?

Yes, several. Better daylight illumination; more attractive views of the outdoors; improved over-all enjoyment of the home.

Wouldn't so many windows cause glare?

On the contrary, they reduce glare by eliminating sharp contrasts of light and dark within a room. At times, when the light is too strong for a short time, Solar house owners say they control it easily by drapes, venetian blinds, screens or other methods.

I read an article which said that the large windows of Solar houses relax the eyes. What is meant by that?

When eyes are "cramped" by opaque wall areas so that vision is limited to about 20 feet, eyes become fatigued more quickly. Large windows provide more interior light, thus relieving strain while reading, sewing, etc., but the window walls enable one to look at a distance and at various shapes and colors, thus relaxing the eyes. Men who work in the open—farmers, lumberjacks, etc.—seldom wear glasses because their eyes function better in good natural light and they see distant views.

How much additional light can one get into a house by using larger windows?

That depends, of course, upon the dimensional expanse of the window area. However, in a "daylight engineering" test of a Solar house living room, lighting experts made an interesting discovery. Using a light meter, they found that there were 39 foot candles of light in the middle of the room. (The test was made about 11 a. m. on an average day.) Then a previously prepared "mask" was put in place along the window wall. It contained three windows, transforming the wall into an ordinary type of living room wall. The operation took five minutes and 10 seconds. The next light meter reading showed only nine foot candles, a loss of 30 foot candles of natural light.

Do Thermopane windows admit ultra violet rays?

No, this healthful or therapeutic ray is not available through any regular glass. (Solar heat involves the infrared rays which provide radiant heat energy.) Some medical men and psychologists point out, however, that people do feel better in cheerful surroundings. The healthful benefits of daylight within a building are brought out in a deeply significant article, "Dust Infection and the Action of Light," published recently in the British Medical Journal. In summary, the medical report stated in part: "In wards where there are patients with haemolytic streptococcal infections, germs were found to be most numerous in floor dust and were absent from many specimens of dust in the same wards collected from sites on or close to window. They were more often found in dust from exceptionally dark wards than comparative specimens from normally lit wards.

"Ordinary diffused daylight is bactericidal to haemolytic streptococcal. The interposition of glass does not prevent this effect, and it occurs even under winter conditions in England.

"These facts suggest the possibility that good natural lighting may be a factor in preventing the atmospheric spread of infection in surgical wards and elsewhere."

Has any occupant of a Solar house ever given you any interesting reactions to living in such a home?

Yes. A Wisconsin housewife, who has lived in one for four years, gave an interesting commentary of her reactions. "We have always lived in a suburban area," she wrote, "but until we built our Solar house I really didn't appreciate the stimulation of being able to observe the day-by-day routine of 'life' that fairly teems all around us. We have really come to know birds and appreciate them. We purchased a book on birds, and now we recognize them quickly.

We are able to study the every-day habits, the playfulness, the industry in squirrels and we have found a vast new interest in growing things . . . We see all this going on hour by hour from our living room, our kitchen, our bedroom."

Poetic? Not at all. Just a typical reaction to Better Living.

Can a Solar house have a cellar?

Yes. Some experts point out, however, that the modern types of heating systems do not require a basement, that first floor utility rooms serve the dual purpose of heating and storage space if properly planned and that stairway hazards are thus eliminated.

How much does it cost to heat a Solar house?

That, of course, varies. It depends upon many factors. However, after a year's test of a Solar residence in suburban Chicago, the Illinois Institute of Technology reported: "A house of similar design but equipped with a heating system better adapted to fully utilize the available solar heat input should show a substantially lower heating cost . . . The preponderance of evidence indicates that the solar heat input in the house tested offset most, and probably all, of the heat losses through the extra window areas." . . . One of the most interesting "heat cost tests" took place in a Solar residence in Glenview, Ill. The house has three large bedrooms, two baths, kitchen, laundry or utility room, a recreation room 20 x 15 feet and a combination living-dining room 32 feet long. The living room alone has a window area of *168 square feet,* which is considerably more than the entire window area of the average house. Heating experts estimated that it would cost $225 to heat the house from Sept. 1 to June 1. Actual bills, however, totaled only $136, a saving of $89. Solar heat input had not been figured in the estimate.

What about Solar houses in southern areas where heating is not a problem in winter?

Assuming that the Solar or open-plan type of large windows or window walls are wanted, the problem is one of better interior temperature control in hot summer months. The insulating properties of Thermopane windows make it ideal to increase the efficiency of mechanical air-conditioning systems, making it possible to use a smaller, less expensive unit, and reducing wear and operating costs.

How about sun fading of fabrics?

Several "Solar housewives" have been asked this question. Some typical replies: "The large windows prevent spotty fading. It is so even that it is not noticeable."

"Yes, we get some fading, but I certainly wouldn't give up these windows just because of that."

"Our furnishings are quite light. We haven't noticed any fading."

Thermopane can be made up of an outer pane of golden plate glass, which filters out most of the rays in the ultra violet range. These rays generally cause many colors to fade. The golden color does not reduce vision. It gives a slight, hardly noticeable tint to exterior scenes.

What materials are used?

Solar housing does not depend upon any specific types of material. Houses can be of wood, brick, stone, stucco, cement or any material commonly used for houses.

How big is a Solar house?

That depends upon the size of a man's family and how much he is able or willing to spend.

What kind of heating should be used?

Solar houses are not dependent upon any specific type of heating system. Whatever fuel is used—gas, coal or oil—or whatever system—steam, hot water, warm air, radiant floor, wall or ceiling "panel" heating—the important thing is that the system should be flexible. It should be of a type which permits heat to be shut off quickly when solar heat is coming in, yet supplies heat rapidly when solar heat is not available.

How much does a Solar house cost?

Obviously, the cost is determined by a number of conditions, such as size of the house, kind of materials used, construction methods utilized, local labor costs and other factors that can be decided only by the individual owner.

SEE YOUR ARCHITECT

Floor plans, sketches and photographs reproduced in this book are utilized only to suggest some of the design possibilities of Solar houses. Libbey-Owens-Ford does not provide complete designs nor architectural specifications as a service.

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In the interests of intelligent planning and design to fit specific needs, Libbey-Owens-Ford recommends that the prospective home owner consult an architect.

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